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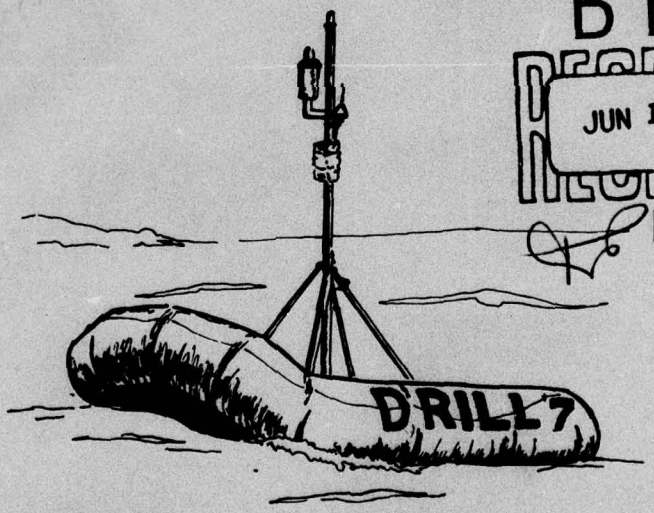
COAST GUARD

# SEVEN MAN LIFE RAFT LEEWAY STUDY










Oceanographic Unit Technical Report 78-1

Technical Report Documentation Page

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| | | |

(6) 4. Title and Subtitle: Seven Man Life Raft Leeway Study • Oceanographic Technical Report 78-1

(11) 5. Report Date: March 1978

6. Performing Organization Code:

(10) 7. Author(s): C.W. Morgan

8. Performing Organization Report No.: TECH RPT 78-1

9. Performing Organization Name and Address:
U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Washington Navy Yard Annex
Washington, D.C. 20590

10. Work Unit No. (TRAIS):

(9) 11. Contract or Grant No.:

13. Type of Report and Period Covered: Oceanographic technical rpt. 1968-1971

12. Sponsoring Agency Name and Address:
U.S. Coast Guard Headquarters (G-000-1/74)
Washington, D.C. 20590

14. Sponsoring Agency Code:

15. Supplementary Notes: (14) CGOU-TR-78-1 (12) 9p.

16. Abstract

Leeway angle is the angle between the direction toward which the wind is blowing and the relative drift, due to the wind, of a drift object embedded in the water surface. Leeway factors is the ratio between the drift object's speed relative to the water and the wind speed. An analysis was made of several hundred observations of leeway angle, leeway factor, and wind speed for a seven man life raft attached to a sea anchor.

086 470

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Wind drift, liferafts, search and rescue | Release unlimited |

| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| Unclassified | Unclassified | | |

Form DOT F 1700.7 (8-72) REPRODUCTION OF THIS FORM IS AUTHORIZED

# SEVEN MAN LIFE RAFT LEEWAY STUDY

By

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March 1978

USCG OCEANOGRAPHIC UNIT
NAVY YARD ANNEX
WASHINGTON, D.C.

Technical Report 78-1

## TABLE OF CONTENTS



## LIST OF ILLUSTRATIONS



## LIST OF TABLES

# LEEWAY ANGLE AND LEEWAY FACTOR PROBABILITY DISTRIBUTION AS A FUNCTION OF WIND SPEED FOR A SEVEN MAN LIFE RAFT ATTACHED TO A SEA ANCHOR


## ABSTRACT

Leeway angle is the angle between the direction toward which the wind is blowing and the relative drift, due to the wind, of a drift object embedded in the water surface. Leeway factor is the ratio between the drift object's speed relative to the water and the wind speed. An analysis was made of several hundred observations of leeway angle, leeway factor, and wind speed for a seven man life raft attached to a sea anchor.


## INTRODUCTION

Leeway angle is the angle between the direction toward which the wind is blowing and the relative drift, due to the wind, of a drift object embedded in the water surface. Leeway factor is the ratio between the drift object's speed relative to the water and the wind speed. During the period 1968-1971 the Oceanographic Unit made a number of cruises to collect data on leeway angle and factor for several types of small craft. This data collection program is described in Morgan, Brown, and Murrell (1977). In this report several hundred of these observations were analyzed for a seven man life raft attached to a sea anchor.

## METHOD OF DATA ANAYSIS

The major problem encountered in analyzing this data was in quality control. To overcome the problem of noise or observational scatter in the data, the leeway angles and factors were determined for time increments of 6 hours. This was done (see program documentation for RAFTL) by computing leeway direction and speed from relative positions of a raft and a current drogue at 6 hour intervals, and average wind direction and speed over the 6 hour interval. The data observations were usually taken on a 15 or 20 minute interval.

The output from RAFTL is a geographic plot of raft movement relative to the current drogue, a plot of leeway angle and factor vs time, and a plot of leeway angle and factor vs wind speed. Such plots were made for each run of observations. Careful subjective inspection of these

plots made it possible to determine which runs contained data which was of questionable validity. Runs or observations of questionable validity were then removed. Table 1 is a listing of all runs reported in Morgan, Brown, and Murrell (1977); in the table is indicated which runs were deleted and the reason for doing so. Those determinations of leeway angle and factor which were not deleted were then combined in a summary plot which was the output of program FINAL. These plots are shown in figures 1 and 2.

## DISCUSSION OF RESULTS

The various runs on figures 1 and 2 are identified by letter in Table 1. It is apparent that other of the data besides that deleted should have been deleted also. Run B, which was conducted near Nantucket Shoals, seems to show the effect of a non-uniform sea current field, thus invalidating it. Run A, also near Nantucket Shoals, has unrealistically high factor value. All of the leeway angle values and leeway factor values below about 5 knots are suspect because the effects of observational scatter becomes more prominant at low wind speeds. On the other hand, the values for low wind speeds do show a trend rather than the random scatter which might be expected.

At wind speeds above 5 knots the leeway angle seems to decrease from values of about $35^{o}$ to the right of the wind at 5 knots to downwind at 10 knots. It seems to remain constant downwind at values above 10 knots. The reason for this pattern is not clear, particularly why the object drifts so far to the right on low wind speeds

At wind speeds above 5 knots the leeway factor seems to remain essentially constant at 0.04, a value basically in agreement with that found by Pingree (1944).

Statistics on the distribution of leeway angle and factor were not computed. Inspection of figures 1 and 2 shows, however, that the range of leeway angles for a given wind speed is about $\pm$ $13^{o}$, and the range of leeway factors is about $\pm$ 0.03.

## REFERENCES

Morgan, C.W., S. E. Brown, and R.C. Murrell (1977) Experiments in small craft leeway, USCG Oceanographic Unit Technical Report 77-2

Pingree, F. deW. (1944) Forethoughts on rubber rafts, Woods Hole Oceanographic Institution. 26pp.

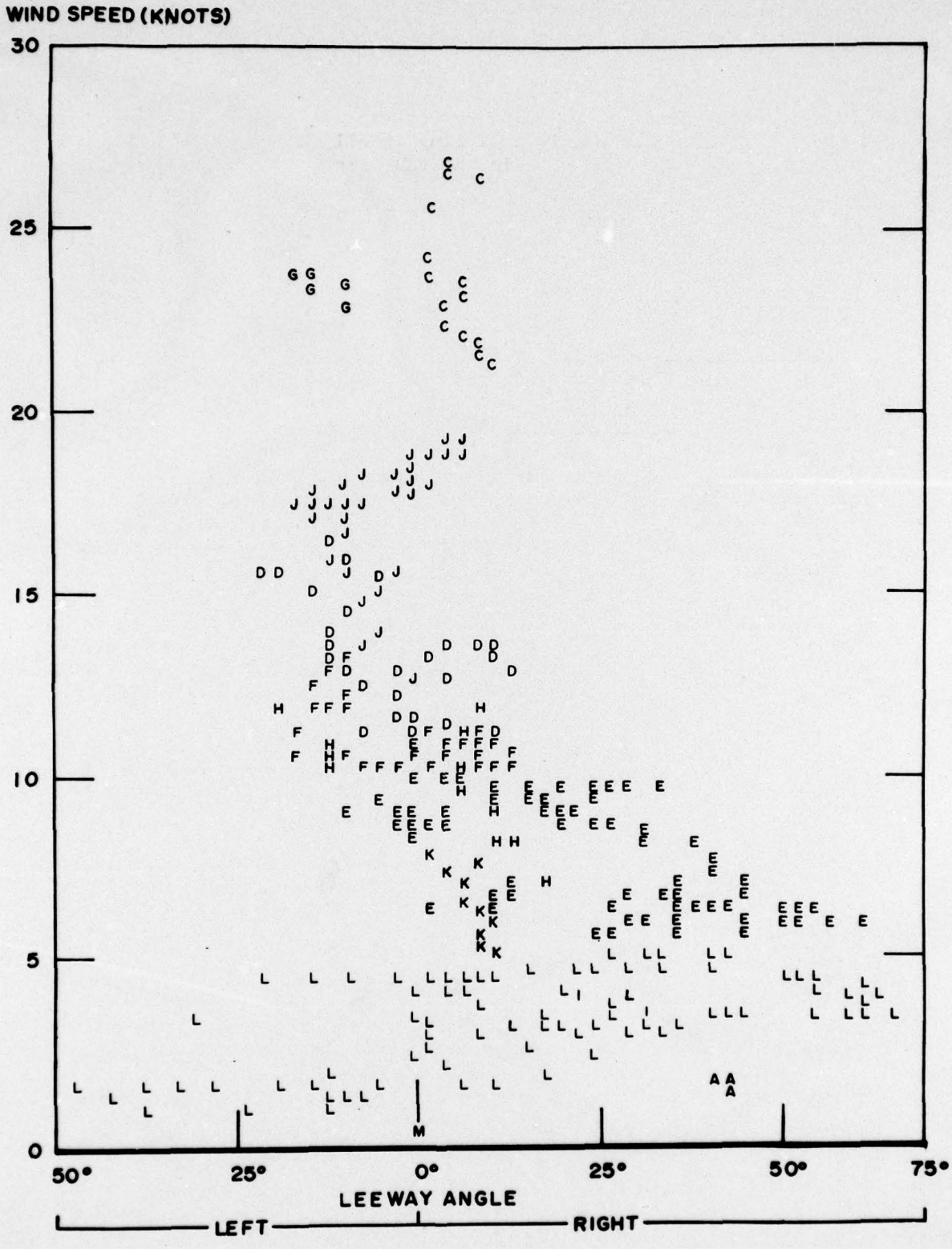


Figure 1 Leeway angle versus wind speed for a seven man life raft attached to a sea anchor.

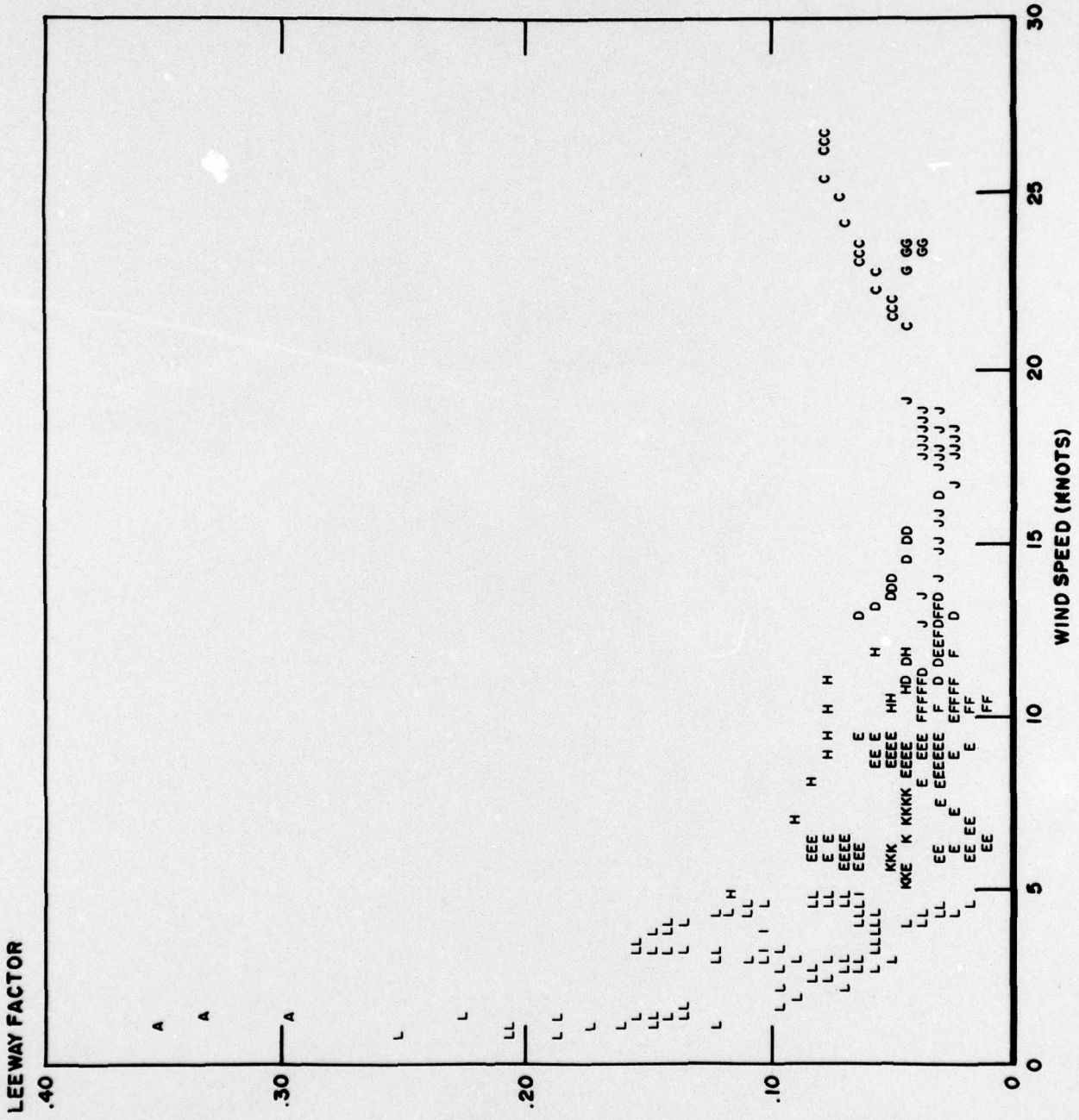


Figure 2 Leeway factor versus wind speed for a seven man life raft attached to a sea anchor.

Table 1

Cruise and Run Listing

| CRUISE | RUN | DELETED | REASON | ID ON FIGS 1&2 |
|---|---|---|---|---|
| SAR Research #1 | | x | No life raft data | |
| SAR Research #2 | 1 | x | Too short | |
| | 2 | x | " | |
| | 3 | | | A |
| SAR Research #3 | | x | Too short | |
| ROSARR 1-70 | 1 | | | B |
| | 2 | | | C |
| BOMEXC | 1 | x | Too short | |
| | 2 | | | D |
| BOMEXL | 1A & 1B | | | E |
| | 2 | | | F |
| | 3A | | | G |
| ROSARR 5-70 | 1 | | | H |
| | 2 | x | Data unusable | |
| | 3 | | | I |
| EVSARR 9-70 | 1 | x | Too short | |
| | 2 | | | J |
| | 3 | x | Non uniform currents | |
| | 4 | x | " | |
| | 5 | x | " | |
| | 5A | x | " | L |
| | 6 | x | " | |
| | 7 | | | K |
| | 8 | x | Non uniform currents | |
| | 9 | | " | |
| | 10 | | " | |
| | 11 | | " | |